Solving Macroscopic Material Balances

General Equation:

$$ACC = IN - OUT + GEN$$

For element balance or overall mass balance, GEN = 0

Simplifications of the material balance:

A. Non-reactive systems

For non-reactive systems no reaction occurs.

GEN = 0

or $R_i = 0$ and $r_i = 0$.

B. Steady-state systems

For steady-state systems, no accumulation occurs.

ACC = 0

Procedure

1. Draw a diagram of the system and label all streams.

2. If necessary, choose a "basis" for the system in order to carry out the calculations. This is accomplished by *assuming* the quantity of material in a stream. (At the end, we will adjust for this assumption by "scaling it" to the correct answer.)

3. Label unknown streams.

4. Convert commonly given volumes or volumetric flows into mass or molar quantities. Remember that we are performing a mass or mole balance, not a volume balance.

5. Convert any mixed units into one basis.

6. Write material balances.

7. Solve equations. Usually one starts with the equation having the least number of unknowns. Sometimes it is necessary to solve equations simultaneously or perform an iterative solution.

8. If necessary, scale the quantities to the appropriate values. This is a correction for any assumption made in part 2 above.